

cent view is obtained of miles upon miles of growing cane, while scattered at several points are the camps of the laborers employed in various fields. In all the plantations upon this side of the island of Hawaii there is a similarity in the methods of planting, general appearance of the cane and methods of transmitting the ripe product to the mill. On the lands of the Honouliuli company are nine miles of main V flumes, while the necessary amount of lateral V flumes tap the cane ready for cutting in various parts of the field. Water to supply the above flumes, as likewise for milling and power purposes, is obtained from streams upon the lands, the principal supply being derived from Kolekole, Pahoa, and Honouliuli streams.

At present the highest altitude that cane is planted is about 1100 feet, but it has been practically demonstrated that cane will do as well at much greater elevations.

In order to facilitate the planting and taking off of crops, the company is rapidly perfecting a system of roads throughout the plantation. These roads are being constructed by contract and, as the price paid per running foot is very reasonable, the expense in their building is more than justified.

The question of labor has been simplified to a large degree by a system of contracts in the building of roads, clearing, planting and cultivation of the lands, as likewise in the harvesting of the cane. In some cases the company furnish the laborer with the land, plow it and furnish seed, the laborers simply cultivating it for so much per ton of cane produced on the lands cared for by them. The number of people directly employed by the company will average 300, while in addition to this there are 175 contracting company men cutting cane, while outside of this there are 100 men building roads and carrying out cultivating contracts. Continual planting of one variety of cane on the lands for a number of years without rotating, necessitates the renewal of the exhausted ingredients in the soil by the use of high-grade fertilizers, using an average of from 500 to 1000 pounds to the acre, according to the condition of the land. The result of this treatment is clearly observed in riding through the magnificent fields of Rose Bamboo canes planted less than a year ago, some of which is now being stripped for the first time. From appearances much of the cane which is less than a year old will ripen in from eighteen to twenty months from date of planting, and will average four tons of sugar to the acre, or from thirty-five to forty tons of cane to the same area.

In the plowing of the soil, clearing of land and road construction, and in various other ways, the plantation requires the use of 105 head of mules and horses, which are accorded the best of care.

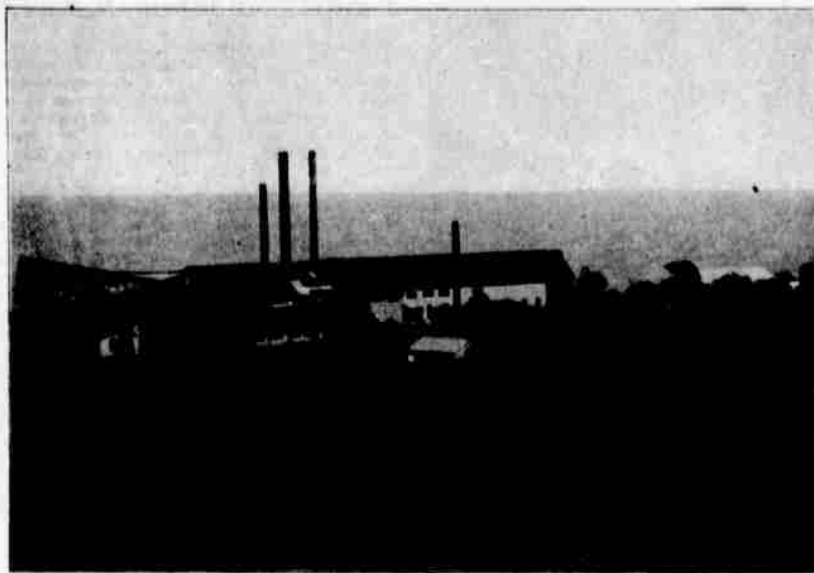
In 1897 the company made a contract with the Honolulu Iron Works for the erection of a complete 9-roller mill which has a capacity for turning out from sixty to seventy tons of sugar in twenty-four hours. The mills, designated as Nos. 1, 2 and 3, are subjected to an individual hydraulic pressure of 305 1-4, 313 1-2 and 338 1-4 tons respectively, and extract from 93 to 94 per cent of the sugar matter contained in the cane.

The mill contains the latest known appliances for the successful treatment of the cane, which consist principally of three vacuum pans, Deming apparatus, ten 30-inch Weston centrifugals driven by Leffel turbine wheels, which can be operated either by water or steam, and making 1350 revolutions per minute; six mud presses, five Blake vacuum pumps 18x18x24 that run two double effects and the three vacuum pans and can change from triple to quadruple, and many other mechanical appliances now in use in all modern mills. To operate this labyrinth of machinery there have been installed furnaces with step-ladder gratings, one Heine water tube boiler and two tandem, one tubular and one Galloway boilers, which supply the steam to operate a 500-horsepower Corliss engine, which in turn drives the principal machinery in the mill. The entire mill and other buildings are lighted by electricity, which is furnished by a 150-light general electric dynamo, directly connected to a marine type of engine.

The machine shop appliances are driven by water power derived from the same source of water that conveys the cane to the mill.

In January of this year the company completed a new mill house and boiler building, which is a steel structural affair and erected by Milliken Brothers of New York. One feature of the mill is a 12-ton overhead traveling crane which can be operated in any part of the mill. A feature of the whole mill is the molasses tank house, built off from the boiler house, thus doing away with so much labor and handling of cars, and keeping the mill in better condition. The above house is supplied with a large Magnus pump, which is used for pumping the molasses back to the mixer when manufacturing third and fourth grade sugars.

A complete chemical department is maintained, where are kept continually daily tests as to how the sugar is cooked, its density, quality of sugar in pans, etc. The quantity of lime used in the clarifiers is from 1 1-4 to 1 1-2 pounds to 730 United States gallons of cold juice, which increases the purity to about 1 to 1 1-2 per cent in the clarification. Out of the three boilings of sugar there is secured 90 per cent of sugar to the ton, while the molasses percentage is eight gallons to the ton of sugar, with a sugar purity of from 23 to 25 per cent. The residual matter which forms in boiling the sugar contains about 13 per cent of sugar, which is reduced to about 1 1-2 per cent by receiving two pressings in the filter presses. The juice from the second pressing is conveyed to the mills by a system of pipes and used for maceration purposes. The milling or grinding season is about six months in the year, during which period



Mill and V Flumes of Pacific Sugar Mill, Kukuiahele, Hawaii

about 5000 tons of sugar are produced, which is principally of the No. 1 quality.

The method of transporting the sugar from mill to steamer is very interesting and consists of an incline tramway from the mill to the landing platform, from which point a cable is attached to the steamer by a line of shore. The cable, which is 800 feet in length, is operated by a steam drum and the rapidity with which several thousand bags of sugar can be placed in the hold of the steamer is remarkable. The company has its own store at Honouliuli, where is also situated the comfortable residence of the manager and head luna.

Following are the officers and principal attaches of the company:

T. May, President.
G. R. Carter, Vice President.
George H. Robertson, Treasurer.
E. F. Bishop, Secretary.
T. R. Robinson, Auditor.
W. G. Brash, H. Waterhouse, Directors.
William Pullen, Manager.
W. K. Andrews, Head Luna.
R. W. Hamilton, Team Luna.
J. M. Smith, Chief Engineer.
William McQuaid, Chemist.
Brewer & Co., Honolulu Agents.

Ookala Sugar Plant. Co.

Located some thirty-one miles from Hilo are the plantation lands of the Ookala Sugar Plantation Company, which controls 6000 acres, 3000 of which area is planted to cane, principally of the Rose Bamboo variety. The area under cane is divided nearly equally in plant and ratoons. Some eighty acres of second ratoons of Rose Bamboo, taken off this year, yielded 3 3-4 tons of sugar to the acre, while the whole average of the cane put through the mill this year was something over three tons of sugar to the acre. The fall plant, depending largely upon rain, will average 3 1-2 tons to the acre, and in June of this year, holding up to that average.

Part of the labor performed upon the plantation is by contract with companies at so much per acre for planting, cultivating, stripping and harvesting of the crop. At present about 225 men are employed under company contracting system, and about 200 are on the plantation pay roll. At the present time no additional area is being cleared, owing to the scarcity of available labor, but it is expected that the unusual dearth of labor on the island will soon be relieved.

The principal varieties of cane grown are the Yellow Caledonia on the lowlands and Rose Bamboo on the uplands, although considerable Lahaina is still grown. The Yellow Caledonia variety, which is creating such a stir as the future cane on the windward side of Hawaii, was first planted on the above plantation about five years ago, at which time seed was supplied by Mr. Walker, the manager, to the Hakalau, Laupahoehoe and Kukaiaua plantations. Subsequently twenty bags were sent to H. P. Baldwin at Haiku Plantation. At this time

the Ookala Plantation practically had planted the first lot of Yellow Caledonia cane grown in the north Hilo and Hamakua districts, since which time it has been more or less planted on all plantations in the above districts.

The Ookala Plantation is supplied with five miles of steam railroad tapping the most available points for reaching the cane fields, and supplied with cars for holding an average of five tons of cane to the car. The altitude for planting at the present time runs from 200 to 1600 feet on a gradual slope from the ocean front, while roads radiate in every direction to expedite operations.

In addition to the railroad and flume system for transporting cane to the mill, the company has erected some five miles of wire rope transmission for transporting cane by gravity from the most inaccessible places in the higher elevations, which system, for simplicity of construction and successful operation, commends itself.

The above system of trolley and sling transmission of cane is in use at the Kukaiaua Plantation, which adjoins the Ookala, but which system so fully described in this report, has many essential features not embodied in the Ookala installation.

There are two separate systems upon the Ookala Plantation. About two and one-half miles from the mill there is a wire rope system connected with the steam railroad, which connects the different neigs, whereby the bundles of cane arriving at the point of discharge onto a platform over and above the cars, is freed from its bindings and trolleys by a simple tripping device invented by the manager.

In order to avoid the handling and hanging of several miles of wire rope, the cable is made in one mile lengths and connected by a simple and ingenious contrivance consisting of a piece of light plate steel four inches wide connecting the two ropes together in the following manner: The rope comes up to the center of the plate and is led off a little to one side and anchored, and the other mile rope is laid in, and this in turn is anchored, and this gives a clear run of the trolley and sling loaded with cane without any hindrance.

The trolleys, of which there are some 3000 in use, are made of cast iron with a steel hook, and are returned to the point of bundling the cane by pack mules and wagons, as are also the rope slings. The object in not unloading direct to the cars is due to the removing of the trolley and slings from the load; otherwise a part of the mechanical attachment might get in among the cane, and thus enter the rollers of the mill and cause damage. The wire rope used is one-half inch in thickness and known as the "Patent Wire Locked," and presents a surface as smooth as a steel bar. The wood braces that carry the wire are made of 6x6 timbers and set apart a distance varying from 700 to 900 feet, while at each brace the trolley and sling loaded with cane pass over a small sheave set on a journal which relieves the sudden jar of the load in passing over, and at the same time forces the

load ahead to the next brace, and so on to the point of dumping. The braces that carry the wire rope are simply made portable and are held together by their own ground weight, and a simple iron clevis at each end of the cross-brace, which can be raised or lowered to any desired height by simply loosening the nuts that hold them intact in place.

The bundles of cane, which weigh from 125 to 150 pounds each, pass a given point at the rate of five bundles a minute, while the number of men required in its operation for a distance of 2 1/2 miles is eighteen men, which include those hooking on the cane to the wire rope, where it has its beginning, the men along the line at one or two points, and the men discharging the cane at the terminus from the platforms to the cars.

The mill for handling the product is a nine-roller mill operated by steam power and having a capacity for turning out sixty tons of raw sugar in twenty-four hours, and supplied with the latest modern appliances, such as six clarifiers, one 10, 8 and 5-ton vacuum pans, triple-effects, four filter presses and eight 30-inch centrifugals making from 1500 to 1600 revolutions per minute. The vacuum pans and triple-effect are operated by separate pumps of the Blake pattern, while the centrifugals are driven by a separate engine.

In order to economize in fuel, all the exhaust steam from the triple-effects, as likewise the vacuum pans, is run into a hot well and pumped into the boilers, thus giving the boilers the benefit of water that is heated to from 60 degrees to 70 degrees.

The nine-roller mill is operated by a 250-horsepower Hamilton-Corliss engine with from 65 to 80 pounds of steam, while the hydraulic pressure on the three mills is 865 tons.

The residual matter resulting from the boiling of the sugar, which contains more or less sucrose, is subjected to dilution, thus reducing the density of the juice to 4 per cent, after which it is put through the mud presses and the extraction is returned to the mill for maceration purposes.

The mill extraction averages about 93.15. The cane is delivered direct to the mill by the endless carrier, the trash being conveyed to the fire-room automatically and fed direct into the furnace by hand. Two grades of sugar are made and designated as Nos. 1 and 2. From the mill the sacked sugar is conveyed direct to the warehouse, at the landing, which has a capacity for holding 9000 bags. The transmission of the sugar from landing to steamer is performed by the aid of a 1 1/2-inch steel "Patent Wire Locked" cable connected to the steamer lying off shore, the steamer making fast to it from a buoy. The capacity of the cable is one and one-half tons to the load, or twenty-four bags, and by this system 7000 bags of sugar can be loaded direct to the steamer in a day of eleven hours.

W. G. Walker, the manager of the above plantation, has followed the industry of cane culture on the Hawaiian Islands for the past twenty-four years, at such plantations as Laupahoehoe and Hakalau, on Hawaii, and Spreckelsville, on the island of Maui. For the past twelve years he has acted as manager for the Ookala plantation.

Following is the list of officers:

Jas. F. Morgan, President.
J. M. Dowsett, Vice President.
Geo. H. Robertson, Treasurer.
E. F. Bishop, Secretary.
T. R. Robinson, Auditor.
M. P. Robinson, Director.

Hamakua Mill Co., Ltd.

The plantation property of the Hamakua Mill Company, Limited, lies on the windward side of the island of Hawaii and comprises a total area of 11,000 acres, which includes cane land and pasture. The total area planted to cane is 4200 acres, 1944 acres of which are plant and 1693 acres ratoons. At present the company is plowing 800 acres by contract, and planting same with Rose Bamboo. Most of the acreage is planted with Rose Bamboo although there is some little Lahaina. The company is going to plant Yellow Caledonia, but to what extent will depend largely upon the results of the cane of that variety now under cultivation. The cane grown is planted at elevations ranging from 160 to 2000 feet, and the first cane planted upon the property was by Charles Nottley in 1878. There are nine miles of railroad on the plantation tapping the various cane fields, and constructed on a 3 1/2 per cent grade.

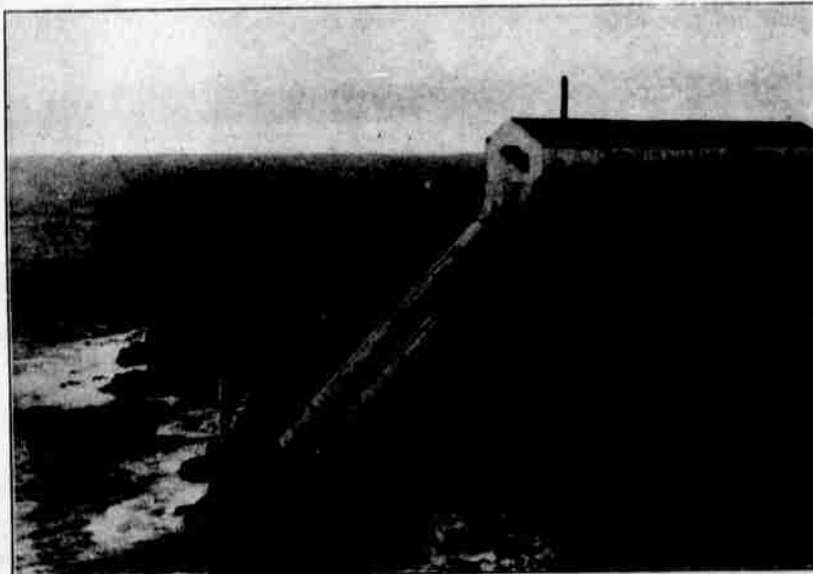
The method of transporting the cane product to the mill is by wagons from the fields to the railroad track, and transferring by means of a combination overhead crane and derrick operated by steam power. The cars, of which there are 100, have a capacity of from three to six tons of cane, and are made up in trains of about twelve cars, conveyed to the mill by steam engines, of which there are two in use, and dumped directly upon the automatic endless carrier and fed to a Ross cutter and from thence to a 3-roller mill.

The average output of sugar for a season's run of seven months is three and one-half tons of sugar to the acre, or about thirty tons of cane to the same area. As on several other plantations, all the plowing is done by the aid of Fowler's steam plowing tackles, which perform excellent work.

At present there are 261 men on the company pay roll, which does not include the company men or contractors, which run the total men employed to 526.

Ingress and egress throughout the cane fields is by the aid of ordinary dirt roads.

The appliances for extracting the sugar product from the cane include first a Honolulu modern 9-roller mill, which has a capacity for turning out sixty tons of sugar in twenty-four hours. The combined hydraulic pressure on the three mills is 776 tons. The other sugar machinery consists



Paaubau Landing on North Coast of Hawaii